NEW DIRECTIONS FOR VISUAL VALUES RESEARCH: ASSESSMENT OF VISIBILITY-RELATED BEHAVIORS AND BENEFITS

Final Report

New Directions for Visual Values Research: Assessment of Visibility-Related Behaviors and Benefits

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In her book, Creating Alternative Futures, Hazel Henderson (1978) the economist and social critic, has observed that traditionally more attention has been paid to property rights than amenity rights. Modern society, however, with its great dependency upon technology has created serious threats to environmental amenities through such factors as increased levels of human caused air pollution. The importance of visibility as an amenity of value has been recognized in the 1977 amendments to the Clean Air Act. Among other things, the amendments require that all class I areas maintain visibility standards for air quality. Such standards, are to be based, in part, on objective and systematic appraisals of the social value of air visibility.

There is a real need to develop meaningful indicators of amenity values. Henderson (1978) observed that some industrialized nations, like Japan, have begun to adjust economic indicators of national growth to allow for amenity considerations and costs such as those incurred in combating unemployment and pollution abatement brought about in a modern technological society. While the potential health effects of air pollution have been a source of concern for some time, only in the past few years has there been objective efforts at instrumenting what is meant by visibility or visibility standards for Class I lands.

The present work was an effort to develop some measures of amenities associated with good visibility in Class I areas. In specific, the effort was designed to identify behaviors thought to be associated with visibility and also to identify perceived benefits that people can derive from their use of Class I Lands. Working lists of both visibility-related behaviors (VRB's) and visibility-related perceived benefits (VRPB's) were generated as part of a series of pilot studies (see Greene, Breeding, and Grant, in press; Loomis and Greene, 1983). In addition, a few field interview responses made by recreationists will be used to illustrate ideas about visibility related benefits and behaviors.

Background

In an earlier paper, the present authors distinguished between magnitude and social values (Loomis and Greene, 1979). Magnitude values, pertain primarily to sensitivity for changing conditions of air quality. It was noted that magnitude values are dynamic in nature and can be influenced by factors such as perceptual sets and psychological adaptation to experienced levels of pollution. Social values (i.e., those perceptions about the importance and meaning of visual air quality) can also influence sensitivity, but are important in their own right and should be studied directly. Social values can include those behaviors and activities directly related to visibility. Such behaviors are subject to modification if there is a change in air quality. Furthermore, changes in activities, or the actual loss of opportunities for specific activities because of visibility impairment, could result in a loss of perceived benefits associated with different settings.

Changes in VRB's and VRPB's are directly tied to assessments of whether or not visibility degradation has measurable impacts on how people

value visual quality. Ultimately, assessment of VRB's and VRPB's could be a useful tool for those who must make decisions about the protection of Class I land areas, public parks, or any pristine area in general.

Fox and Rosenthal (1981) suggest that a management decision tree could be an effective tool in determining if approval or denial should be recommended for new emission sources. Effective use of a visibility impairment decision tree as suggested by Fox and Rosenthal would require determining key decision points and identifying critical information that would input into the decision process. These authors believe that: (1) whether pollution is perceptible to an observer, and (2) whether impacts of perceived pollution can be considered as impairment are two key decision points. A major limitation to implementation of any decision process model is the amount and quality of research information available. The search for what has been called amenity value in this paper is central to producing information that can be of use in making decisions. Amenity value research can develop information specifically for use at the impairment assessment decision stage identified by Fox and Rosenthal.

While this paper will concentrate on developing amenity or social value research for the visibility problem, it is important to look at the whole array of research questions that could be asked about visual values. Consistent with Fox and Rosenthal, a decision process will be used as an analysis tool. The decision analysis, however, will be from the perspective of the observer, the recreationist or park visitor who is confronted with a series of questions about his/her sensitivity to visual air pollution and the potential of impaired amenity values that could result from the pollution being noticed.

Mapping the Course of Visibility Values Research

Nelson and Kaplan (1983) have identified five stages in the development of any social or public policy: (1) problem identification, (2) problem definition, (3) policy program determination, (4) treatment intervention (manager decision) and, (5) evaluation/assessment of policy and decisions. Research results, of whatever kind, can be used at any of the five stages to help in policy development. These authors caution, however, that there is a tendency to move too quickly through the second stage of problem definition. Identified problems become defined in terms of the first ideas presented or the initial research paradigm used. Only later is it realized that these early definitions are inadequate and other aspects of the problem must be defined and studied.

Visibility as an air quality problem was identified with the 1977 Amendments to the Clean Air Act. There is a need to make sure that an adequate definition of the problem is developed. This need is particularly evident since the visibility problem is heavily involved with psychological and social concepts as contrasted to earlier definitions of air pollution developed around physical or health variables. Table 1 presents a decision tree for observers of air quality and also a suggested list of defined research problems. The purpose of the decision tree is not just to suggest what questions about air quality confront the observer, but also open up discussion about the definition of the whole visibility values topic. It is the authors opinion that there is not, at present, a complete problem definition and Table 1 summarizes one effort at defining the scope of the problem.

Table 1

Hypothetical Observer (Visitor/Recreationist) Decision Tree For Impaired Visibility With Suggestions For Related Research

Question	Decision: Concern	Decision: No Concern
Is visibility impairment detectable?	yes	no
What are levels of detection sensitivity? Does sensitivity vary as a function of both level and type of impairment (i.e., layered versus uniform haze, color of plume, plume-sky contrast)? Do individual decision strategies vary as a function of adaptation level of personal experience with air pollution?		
Does visibility impairment detract from aesthetic enjoyment?	yes	no
Are estimates of scenic beauty differentially sensitive between types and levels of impairments? Are some conditions of impairment viewed positively and others negatively?		
Where does an observer place (attribute) blame for visibility impairment?	human source	natural source
Can anecdotal field accounts of recreation/visitor concern about human-caused pollution be scientifically documented? Does attribution influence other assessments (i.e., aesthetics, benefits)?		
Are site-specific behaviors influenced by impaired visibility?	yes	no
What are visitor-recreationist behaviors (activity choices) that might by impacted by impaired visibility? Can changes in site-specific behavior due to impaired visibility be objectively documented?		
Are expected benefits of site-use affected by impaired visibility?	yes	no
What are visitor-recreationist expectations and perceived benefits that might be impacted by impaired visibility? Can loss of benefits be objectively documented?		
Does impaired visibility in Class I areas influence social/economic values?	yes	no
Is there public concern or acceptance over changed levels of visibility? Is there willingness to pay for air quality? What social policy problems can be identified and studied?		

Table 1 also contains some specific research questions, the answer to which would provide information to use in the management decision procedure advocated by Fox and Rosenthal (1981). While some of the research questions are being investigated, others have received little attention. Furthermore, there is a natural tendency for investigators to limit their work to a particular part of the decision tree (Table 1) and have little interaction with researchers looking at other definitions of the problem. In contrast, managers of natural resources need to be cognizant of all aspects of of defining the visibility problem. As Fox and Rosenthal appropriately observe, different managers may use different points of information to make a decision applicable to their particular situations.

The observer decision tree put forward in this paper also, like that of Fox and Rosenthal, starts with a question of detection of visual air impairment. However, the question of detection levels is not a simple one. In fact, a common emphasis in all of the questions posed in Table 1 is that the psychological and social information necessary to answer a question will be complex in nature and inter-related with other questions that make up the definition of the visual values problem.

Three specific points need to be made concerning observer sensitivity to visual air quality. First, the common sense idea that sensitivity levels are obvious should be resisted. Actual sensitivity levels should be empirically documented and may involve very specific perceptual variables. Henry (1979, 1983) is one of the few investigators who has talked about a psychophysics of visual magnitude values where the specific variables of air quality impairment (i.e., color and transparency of haze) are related to this optical functioning of the eye. Second, it should not be assumed that sensitivity is constant across different kinds of air pollution conditions.

Some features of layered haze, for example, may be more easily detectable than others. It could be very useful to have expected sensitivity curves generated for different levels and conditions of impaired visibility in Class I areas. These curves could be related to frequency data describing the occurrence of days with critical levels and types of pollution (see Fox, no date, for a discussion of this idea). Both sensitivity and frequency of occurrence data should be related to visitor and/or recreationist use patterns in terms of vistas, trails, etc., that are used during periods of detectable air quality impairment.

Third, it must be acknowledged that basic sensitivity or detection of visual impairment can be influenced by other psychological variables: Styles of decision making and psychological adaptation to experienced levels of impairment are two potential mediating variables in sensitivity assessment. Loomis and Greene (1979) and Fox (no date) have stressed the importance of separating observer bias or decision criteria from sensitivity to visibility impairment. A resident from Los Angeles might be quite conservative in his/her willingness to label a vista in a class I area as impaired visibility when compared to an observer from Montana who considers any emissions visible in the air as impairment or pollution. Both individuals are sensitive to the level of impairment present, but each uses their individual background for determining whether they are looking at "pollution" or socially significant amounts of visibility impairment. Each observer has adapted to a different background level of experience with visible air pollution.

A recent study of how people assess Los Angeles basin area smog illustrates psychological adaptation and observer decision strategies (Evans, Jacobs, and Frager, in press). These investigators had student subjects who were either recent or long term residents in the Los Angeles area basin determine

if air pollution (smog) was present in a series of scenes depicted in slides. A visual signal detections task was utilized which made it possible to distinguish sensitivity from decision strategy. For scenes containing low levels of air pollution, both groups responded in a similar manner and displayed equal accuracy for detecing the presence of visual impairment. Long term residents, however, were much more conservative at deciding if "smog" were present in high level pollution slides. Their personal experience with heavy smog conditions had led to a different adaptation level for decising when a major impairment condition existed and this behavior is consistent with psychological adaptation theory (Appley, 1971).

The consideration of decision bias and adaptation level leads naturally to the second observer question contained in Table 1. Concern exists if observers can detect visibility impairment, but it is also important to determine how they evaluate the impairment in terms of enjoyment or aesthetic reactions. Color of layered haze, transparency of haze, extent of plume formations could be evaluated as detracting from the amenity values of vistas and natural scenes or adding to a positive aesthetic experience. Haze can obscure important vista points or cause undesirable discoloration. On the other hand, haze can create a sense of mystery or help produce a dramatic sunset. It cannot be assumed that the presence of air pollution automatically reduces the aesthetic or amenity value of scenes.

The present authors consider efforts at using scenic beauty estimations (SBE's), Latimer, Hugo, Hern and Daniel (1983) or perceived visual air quality (PVAQ), Malm, MacFarland, Molenar and Daniel (1983) as aesthetic assessments since subjects are asked to make some kind of evaluative judgment and not just perform a detection task. These studies should not be confused with the need to determine observer sensitivity and decision bias discussed

previously. Significantly, both studies just cited suggest that factors in a scene such as cloud formations and existing illumination conditions can influence SBE responses and that layered haze which obscures a distant viewing target may be more intrusive (as assessed by PAVQ's) than haze formations that do not obscure scenic formations. It should be expected that a psychology of visual aesthetics will evolve out of research on observer assessments of visibility and become one way of defining the research problem.

The third question in Table 1 raises an issue that has received little empirical attenion, but is of major importance to natural resource managers. How people react to impaired visibility could greatly depend upon where they attribute the source of pollution. In another paper, the current authors demonstrated that attributing impaired visibility to human or natural causes can influence how a sample of student subjects judged the visual quality of scenes (Loomis and Greene, 1983). While such a study is very limited, it is consistent with anecdotal stories the authors have heard from management personnel that visitors and recreationists do distinguish between natural and human caused visual impairment and are much more concerned if they think the latter is responsible for what they see.

Attribution of cause to perceived events is a very basic idea in psychology (Heidler, 1944, 1958) and emphasizes the observer as an active agent and not a passive instrument. Incorrect attributions can have implications both for managers in industry and Class I land areas. An error exists whether people attribute natural haze to human causes or consider human produced pollution as a natural event.

This question of attribution of cause also raises issues of public information and interpretation of detectable conditions of impaired visibility.

Thus, the third question facing an observer of impaired visibility in a Class I area is a specific example of the kind of information tasks that must be dealt with if there is to be a competent and informed public assessment of visual air quality (see Stewart, 1983).

The next two questions contained in Table 1 will be discussed more fully in the next section of this paper and will be mentioned here only in the context of the complete decision tree facing the observer. If there is concern over the detection, aesthetic evaluation and perceived source of visibility impairment the next two questions focus on impacts of visual quality. Will people change their activities and utilization of Class I areas because of visibility impairment? Are there identifiable benefits that will be lost by changing patterns of use? Such questions are at the heart of both impact analysis and amenity evaluation.

Recent investigations (Malm, Shaver, and McGlothin, 1983), point to some useful research paradigms that combine variables of user perception, enjoyment and activity. These paradigms need to be developed further and validated. There is also a need to identify examples of visibility-related behaviors (VRB's) and visibility-related perceived benefits (VRPB's) that could suggest meaningful scenarios and specific variables to use in logic-based utility models such as developed by Malm et al. (1983) or Rae (1983). A more complete identification of VRB's and VRPB's could help respondents make more meaningful estimates of willingness-to-pay by identifying those visibility related attributes of Class I areas that are most salient to people who use the settings.

There is still a broader level of social value analysis as suggested by the sixth and final question posed in Table 1. Suppose an observer has

answered all the other questions in a manner that suggests concern over air quality in Class I areas. Is the observer's concern sufficient to complain to management or write a letter to a Congressman? Is he/she willing to pay special user fees, higher taxes or higher utility bills to support efforts at preventing or reducing visibility impairment? Many researchable problems can emerge around the definition of visibility impairment as a broader social values and policy research topic.

The first five questions have emphasized on-site observer concern (or lack of concern) with visibility impairment. This last questions considers observer concern whether at a Class I site or not. In fact, the broad social policy definition of visibility values could include concerns of people who have never used pristine land areas but consider the existence of such places important. Craik (1983) has identified at least three different roles an observer might play: (1) the landscape assessor, (2) the scenic tourist, and (3) the citizen.

The landscape assessor role is definitely implicated in the first three questions posed in Table 1. It is essential that a valid and reliable research paradigm (or group of paradigms) emerge to provide the best assessment of sensitivity, aesthetic evaluation and cause attribution of changes in visibility as is possible. Craik is also correct in emphasizing the importance of on-site visibility evaluation (in the model of landscape assessment) and the careful validation of any surrogate methods that would substitute for on-site data collection.

Craik's second observer role fits well into questions four and five of the observer decision tree discussed in this section. The park visitor and/or recreationist will view air quality in the context of one attribute in a group of attributes that make up a Class I setting and provide specific

activity and benefit potentials.

Finally, question five includes the role of the citizen-at-large and, as Craik notes, (1) their views about federal land management policies in general, (2) specific land manager policies concerning protection of scenic views and how such policies are determined, and (3) their judgment as to what are acceptable levels of scenic quality. The role of the citizen-at-large may be very important if Rae (1983) is correct that inclusion of existence values (see also McConnell, 1983 and Randall and Stoll, 1983) is necessary to augment on-site willingness to pay values in order for necessary resources to be accumulated for reduction of visibility impairment.

To review, a complete definition of the problem of visibility or visual values must include a variety of questions observers and/or citizens ask about visibility quality and protection in Class I areas. Each question can provide some direction for research. There is a need to break away from provincial research strategies that have defined the visibility problem in a very limited domain of study. Managers of Class I areas need a variety of information that reflects several research directions. As Fox and Rosenthal (1981) suggest, managers must have a variety of dependable information to make decisions at critical points of review. The first set of research problems all center around a basic question of sensitivity or ability to detect impaired visibility of any kind. The remaining observer questions discussed in this section all focused on some aspect of amenity values as a way of assessing the impact of visibility impairment. Impairment could be assessed as a decline in aesthetic enjoyment, an intrusion of human caused pollution into natural settings, a modification or change in class I visibility-related behaviors (VRBs) and a change in visibility-related perceived benefits (VRPB's). In addition, managers should be aware of the potential of a public outcry or a social movement, not unlike that focused on nuclear energy, brought about

by concern over the polluting of pristine settings and the loss of a national resource. The intensity of a citizen-at-large reaction could vary from environmental action groups lobbying for government intervention to a more emotional, media stimulation protest movement.

The remainder of this paper will focus on the fourth and fifth questions from the visibility observer decision tree in Table 1. Amenity values associated with visibility impairment can be discussed in terms of user behaviors and perceived benefits.

Identifying Visibility-Related Behaviors and Benefits

Consider the following two responses to a field interview about visibility in a Class I area. They represent two different patterns of concern, although both acknowledge that visibility is a major reason for being in the area:

Weather: clear, mild; excellent visibility.

Respondent A
11:00 a.m./ 50 yr. old man; Muncie, IN
This is my first time out here. The main reason why people come out here is to see the mountains. However, I could get used to reduced visibility, (especially if it were a necessary sacrifice in the name of progress).

Respondent B
11:15 a.m./ 20 yr. old man; Atlanta, GA.
(Visibility) is what you come up here for. You want to get away from the pollution. There's a certain value in looking at a vista, or the ability to see for miles. We don't care if it rains, because there's a big difference between (inorganically and organically induced reductions in visibility).

Respondent A was clearly thinking in terms of tradeoffs between concern about visual quality and "progress" or the maintenance of modern lifestyles. Both responses demonstrate points made in the last section that visibility is related to activities, perceived benefits and broader social policy issues (such as defined in energy consumption and pollution producing terms) and preservation of natural resources.

Both of the responses cited above were part of pilot study interviews conducted in a Class I area that provided a variety of dramatic vistas as

well as more short range or immediate range landscape viewing. Hikers using the trails in this area were interviewed at random with a conversational interview protocol that contained questions about the importance of visibility, feelings associated with viewing experiences, preferences for specific viewing opportunities and perceived effects of reduced visibility on activities and the general value of recreational experience. Interviews were conducted over a two week period during a fall period and will be used in this paper to illustrate visibility concerns facing the user of Class I lands.

The sophistication of respondents about air quality varies dramatically as would be expected. Stewart's (1983) distinction between naive and informed respondents is well illustrated in visitor comments. The following interview excerpt reveals an extensive response and one that summarizes a number of the research questions posed in the observer decision list of Table 1.

> Weather: clear, mild; excellent visibility
> Respondent C
> 1:45 p.m./ 27 yr. old man, Houston, TX. I'm currently on a board for Air Pollution Control, so I know what concessions one must make when dealing with both conservationists and industrialists. As progress continues without sincere regard for the environment, degradation of the natural environment is eminent. Again, there are certain concessions the public must make—one of them being a reduction in visibility. You can't stop the pollution from floating in from wherever the origin, but you can make sure those coal-fired power plants have scrubbers. I'd also limit the number of cars allowed into the park, which constitute a substantial amount of haze already visible in some areas. However, on the subject ofnaturally caused reductions in visibility, I know that I just have to wait for the haze to lift when the dew evaporates in the morning hours in the spring. We're not big distance viewers, for we also like to sit and look at the lay of the land. However, if the visibility were to be reduced beyond a slight haze, such as the equivalent to the dew rising, it would affect my enjoyment of the area. One thing you have to keep in mind is who you're talking to.
>
> Urbanized people have a tendency to be desensitized to haze and high pollution levels. On the other hand, country dwellers are more aware of a haze and lower pollution levels. It also matters whether a person has come here for the first time, or whether one is a regular visitor. A person who has come here for the first time won't notice reduction in visibility that regular visitors would. Although tourism is big in this state, people aren't going to look at reductions in visibility in the same light as someone who personally sees degradation from year to year.

It goes without saying that respondent C is not very typical of the visitors sampled and has an understanding of many aspects of a complex social problem involved in air quality control. It is important to understand the range of background knowledge respondents have in any assessment of social values associated with visibility.

Visibility-Related Behaviors (VRBs). In order to identify a number of VRB's subjects in a laboratory experiment on visibility value (see Greene, Breeding and Grant, in press) were asked to indicate what activities they would be likely to engage in if they were actually in a variety of settings pictured in a series of eight slides. The slides all contained some vista area in the picture although the ratio of terrestrial to sky emphasis was varied across the pictures shown to a total of 78 subjects. A structured list (see Table 2) of 14 potential recreation activities was given subjects. Subjects were also allowed to nominate activities not mentioned in the list. A wide variety of additional activities were nominated (i.e. eat/drink, both nordic and alpine skiing, walking, relaxing, visit with friends, drawing/painting, contemplation/thinking), but the frequency of nominations was below that of any of the listed behavior choices. First and second choice activity nominations are tallied in Table 2 (some subjects made more than one first or second choice which accounts for the total number of nominations). Two caveats are in order in reviewing the activity nomination data. First, the nature of the pictures would suggest different activities and there is little guarantee that subjects were that aware of vista attributes in making their choices although they knew they were taking part in a visibility study. For this very reason, a variety of outdoor recreation scenes (including a city park location) were used as stimuli. A second limitation of the nomination data is that they were based on a sample of students enrolled at a Rocky Mountain land grant

Table 2

Frequency of Activity Nominations for First And Second Choices of Visibility-Related Behaviors (VRB's) in Slide Scenes (N=78)

Behavior (VRB)	First Choice Nominations	Second Choice Nominations	Total Nominations	Percent of Total Nominations (round
Taking Photographs	58	69	127	10
Backpacking	62	59	121	9
Horseback Riding	59	62	121	9
Observing Wildlife	62	43	105	8
Contemplating Nature	45	59	104	8
Fishing	48	47	95	7
Mountain Climbing	44	50	94	7
Sunbathing	68	19	87	7
king	42	45	87	7
Hiking	18	62	80	6
Jogging	14	65	79	6
Hunting	63	15	78	6
Camping	10	47	47	4
Swimming	42	12	54	4
Other	14	17	31	2
	Total First Nominations: 649	Total Second Nominations: 671	Grand Total: 1320	100

university. Subjects, however, were screened to insure that they were active participants in outdoor recreation activities.

How might the laboratory based activity choices compare with behaviors in real life? The authors' completed a pilot study of unobtrusive VRB's for hikers on a popular trail in a Class I area (see Loomis and Greene, 1983). The on-trail observations brought out more specific or molecular categories of behavior. For example, visiting with friends was a mentioned activity in the other category in the laboratory study, but the major trail site behavior observed. On-site VRB's were specific actions (i.e., pointing to a vista, talking to other hikers, shading eyes to improve a view) necessary to accomplish the broader VRB categories (hiking, taking photographs, contemplating nature, etc.) defined in the laboratory protocol. The field observations also revealed that specific VRB's would occur at defined points along a trail such as when there was a change in topographic features. Visibility-related-behavior should be thought of as both general activity choice and as very specific on-site behaviors.

Visibility impairment, as discussed by Fox and Rosenthal (1981), could be assessed as a problem in behavior setting analysis (see Wicker, 1979). People seek out a specific place because of anticipated activities and experiences usually found in that setting. Once in that chosen setting, they engage in particular behaviors that make the anticipated activity a reality and define the setting itself. To the extent that visibility is an important attribute, impairment of visual quality could change the anticipated behaviors associated with a Class I setting and also alter setting specific behaviors undertaken if visitors are actually in the setting.

To get a better idea as to how importnat visibility is to recreation activities associated with different settings, subjects in the experiment being

Table 3

Mean Ratings of Desired Levels of Visual Air Quality Needed For A Satisfactory Experience of First and Second Choices of Visibility (N=78) Related Behaviors (VRB's)

First Choice		Second Choice	
Activity	Rating	Activity	Rating
Sunbathing	7.75[a]	Sunbathing	7.36[a]
Taking Photographs	7.34	Taking Photographs	7.16
Mountain Climbing	7.27	Mountain Climbing	7.11
Hiking	6.60	Hiking	6.52
Backpacking	6.56	Backpacking	6.42
Hunting	6.52	Hunting	6.49
Observing Wildlife	6.40	Swimming	6.42
Contemplating Nature	6.34	Observing Wildlife	6.41
Swimming	6.30	Contemplating Nature	6.35
Horseback Riding	6.00	Horseback Riding	6.03
Biking	5.88	Biking	5.80
Camping	5.79	Camping	5.57
Fishing	5.45	Fishing	5.40
Jogging	4.75	Jogging	4.81
Other	3.64	Other	4.22

[a]A 10-point rating scale was used with larger numbers indicating higher desired levels of visual air quality

discussed were asked to do an additional task. They were instructed to rate the desired levels of visual air quality needed for a satisfactory experience of their first and second choide activities (see Table 3). The ratings in Table 3 probably are closer to revealing true VRB's since subjects were now instructed to think about visual air quality in relation to activities nominated during the slide viewing task. Not surprisingly, there were a few changes in the position of activities when visibility is clearly implied. For instance, sunbathing moved from a middle range activity nomination to the highest rating for desired level of air quality in order to experience a sunbathing activity. More central to visibility, are behaviors such as photograph taking, hiking and observing wildlife, all of which were rated as requiring higher levels of air quality. The data of Tables 2 and 3 should be inspected together to define a VRB that is both an expected or desired activity and also related to higher desired levels of air quality.

The field interviews also yielded responses which suggested VRB's and the importance of relating activities to visibility:

> Weather: cool, cloudy; reduced visibility.
> Respondent D:
> 2:45 p.m./ 20 yr old woman; Cleveland, OH.
> It's (visibility) what you come up here for. We've been taking pictures of everything. To us, visibility is very important. If anything were to threaten it, we would want something to be done about it. As far as natural degradation is concerned, it's all a part of what you are seeing. Artificial degradation from outside sources is something we feel that there is little that can be done about it, although we wish there were.
>
> Respondent E:
> 3:00 p.m./ 30 yr. old man; Houston, TX.
> It's (visibility) very important. That's what I came up here for. It makes me feel small. I stopped to look across vistas, but I also enjoy the woody areas where it's quiet. Of course I would be affected by a reduction in visibility! I mean, if I came up here and found it polluted, I'd absolutely (cry). But, then again, it depends upon how many trade-offs you have to make to keep it this way. Yes, you come up here to look at everything.

These two responses are interesting both because they link activities to visibility and also reveal something about social value judgments that range

from a sense of helplessness to a trade-off conception about the management of air quality in Class I areas.

Consistent with many of the questions raised in this paper about researching the social value of air quality is the following response:

> Weather: clear, cool; excellent
> Respondent F:
> 1:00 p.m./ 23 yr. old woman; New Haven, CT.
> It's (visibility) important, sure. My activities are affected by any reduction in visibility. I really didn't feel much like walking around a couple of days ago when it was overcast up here. If pollution were the cause of the reduction, it wouldn't affect me that much because I come from Connecticut where all you see is smog. I'm more concerned with the effect pollution has on vegetation.

Psychological adaptation is clearly suggested in the above comment. The woman viewed visibility as important but clearly distinguished attributions of natural versus human-caused behind impaired visibility. In addition, she related pollution to her adaptation with high levels of impaired air quality in non-Class I settings. It is interesting to speculate if the respondent really would be unaffected by pollution reduced visibility in Class I settings. Would she travel to the interview site and walk around if haze and/or discoloration existed in the air? Her comment about vegetation demonstrates that people can (and do) relate air quality to a variety of effects .

One final interview response is particularly illustrative of how visibility could impair activity:

> Weather: clear, cool; excellent visibility
> Respondents G:
> 4:30 p.m./ 55 yr. old man, rural town in Iowa
> The best word I could use to describe how important visibility is 'very'. Take that vista up there. It would be worthless to us if we were unable to see it. As photographers, visibility is extremely important. After all, you have to be able to see (with reasonable clarity) what you are photographing. If for some reason there was a haze obscuring the nooks and crevices up there, a photograph of that would be that much less valuable. Also, there is a relaxing feeling about being able to look out across over the peaks. That's what we came here to enjoy, as well as the splendor of the aspen.

Significantly, photography was the most frequently nominated VRB and also received the highest desired air quality rating in the laboratory experiment. The field interview excerpt provides a good insight into just how significant visibility is to a person who values taking photographs as a major VRB in a Class I area.

The last comments about photography introduce the notionof benefits derived from the association of visbility and Class I settings: Relaxation is mentioned as a result of being able to see across a vista. The benefit of relaxation is part of the experience of being able to take pictures and enjoy visibility along with viewing specific features such as Aspen trees turning to their fall color.

Visibility-Related Perceived Benefits (VRPB's). As already mentioned, impairment of amenity value can also involve loss or reduction of perceived benefits that are related not just to experiencing Class I settings, but also visibility levels found in those settings. Note the following excerpts from the field interviews:

> Weather: clear, mild; excellent visbility
> Respondent H:
> 1:15 p.m./ 25 yr old man. New Milford, CT.
> We came up here for enjoyment and relaxation. I even got off work to be here. We just like to look at anything that catches our eye--not necessarily vistas, but the land in general. It would be a real drag to (have the view obscured in some way, especially by pollution). There are too many people here. They're nice and all, but we prefer to be by ourselves and enjoy the trail without encountering a lot of people. We came here to get away from all that (pollution and people).

> Weather: cool, cloudy; reduced visibility
> Respondent I:
> 4:00 p.m./ 22 yr. old man; Long Island, NY.
> Visibility is very important to me, especially when I can barely see across the Sound when the weather is good back home. It's like a Holy Place here. It's the most beautiful place I've ever seen. It makes me thank God that I'm alive to enjoy it. I don't mind the rain--I can still see a lot.

Weather: clear, cool; excellent visibility
Respondent I:
11:30 a.m./ 30 yr. old man; Co.
Visibility is very important. It's consciousness arousing to be able to view a vista. It's mind expanding. If it were to be reduced naturally, that would not bother me because I know I could move somplace else to remedy it. An artifically induced reduction in visibility would inhibit the mind expanding experience.

All of the field interview responses just cited refer to benefits (i.e. relaxation, reverence or spiritual experience, mind expanding) the respondents perceived as being associated with Class I lands and, because they were specifically prompted to think about it, also associated with visibility. In order to generate a working list of possible VRPB's, subjects in a visibility laboratory experiment (Loomis and Greene, 1983) were asked to rate the likelihood of experiencing each of twenty benefits while hiking at a site pictured in a slide. Pictures used contained middle-range vista content and had moderate levels of visibility impairment present. Table 4 contains a summary of perceived benefit ratings made by the total sample of 36 subjects. It should be kept in mind that these ratings obviously reflect a composite of the visibility aspects and other topographic features of the scenes pictures in the slides. The perceived benefits list is a slightly modified version of one used in recreation research (see, for example, Driver, Rosenthal and Johnson, 1979; and Driver, 1976).

Other outcomes of the laboratory experiment relate the VRPB's more directly to visual quality. The 36 subjects were divided into three subgroups and viewed the scenic slides under one of three different attribution of impaired visibility instruction sets: Natural haze present, wildfire caused haze present, and human caused haze present. As reported by Loomis and Greene (1983), subjects in the human caused visibility condition rated the air quality lower than those in either of the natural cause conditions. This pattern of lower ratings being given in the human cause attri-

Table 4

Means and Standard Deviations for Estimates of Likelihood of Experiencing Suggested Visibility-Related Perceived Benefits (VRPB's) in Settings Portrayed in Slide Scenes (N=36)

Description of Visibility-Related Perceived Benefits (VRPB)	Estimated Likelihood of Realizing Perceived Benefit		
		$\bar{X}$	σ
1. Mental Relaxation	1.	4.17	.81
2. Appreciation of Nature	2.	4.11	.56
3. Getting Exercise	3.	4.29	.62
4. Enjoyment of a Very Natural Environment	4.	4.20	.58
5. Feelings of Health and Vitality	5.	4.16	.60
6. Physical Relaxation	6.	3.65	1.08
7. Experiencing Solitude	7.	4.38	.67
8. Enjoyment of Scenery	8.	4.07	.75
9. Artistic or Creative Expression	9.	3.69	.88
10. Enjoying Night Scenes (e.g. stars & moon)	10.	4.13	.71
11. Understanding the Lay of the Land	11.	3.76	.75
12. Reflecting on Pleasant Memories	12.	3.78	1.03
13. Companionship with Friends or People With Similar Values	13.	4.28	.68
14. Getting Away from Civilization for A While	14.	4.38	.65
15. Experiencing Tranquility	15.	4.21	.78
16. Getting a Change From Your Everyday Life	16.	4.37	.57
17. Enjoyment of Distant Vistas	17.	3.73	.93
18. Enjoying Sunrise/Sunset	18.	4.19	.74
19. Enjoyment of Open Spaces	19.	3.87	.85
20. Developing Personal Spiritual Values	20.	3.45	1.10

[a]Five-point scale used; higher the number, greater the estimated likelihood of benefit realization

bution condition also was found for the VRPB's listed in Table 4. Lower ratings were given to 19 of the 20 benefits by subjects in the human cause conditions when compared to ratings made by natural haze condition subjects ($U=74$, $N_1 = 20$, $N_2 = 20$, $a = .001$; Mann-Whitney U Test). These results are quite tentative and based on a pilot experiment using a small sample of student (12 per condition) subjects. However, the results make intuitive sense in terms of the observer decision process described earlier in this paper.

People may well lower their estimates of VRPB's if they attribute perceived visibility impairment to a human cause. Furthermore they may also evaluate aesthetic attributes of visibility lower if they think human caused pollution is present and detectable. These potential outcomes are worth following up as significant examples of how visibility impairment could be documented as an influence on amenity values.

Summary and Conclusions

The question of amenty values associated with visibility in Class I lands can, and should be studied with a variety of research paradigms and measurement tools. Each approach to defining the problem could yield a particular set of outcomes that would apply to specific management situations. While the authors agree with Fox and Rosenthal (1981) that detectability and impacts of visibility impairments are critical decision points, this paper has revealed that there are a number of research questions involved with developing information for assesing detection and impairment.

In particular, this paper has stressed that it would be useful to define and assess the impact of visibility impairment on behaviors and perceived benefits of Class I lands that could directly be related to visibility as one

attribute of pristine settings. Beginning lists of both Visibility-Related Behaviors (VRB's) and Visibility-Related Perceived Benefits (VRPB's) were generated and discussed in terms of a small sample of pilot interviews with users of a Class I area.

References

Appley, M. H. (Ed.), 1971. Adaptation Level Theory. New York: Academic Press.

Craik, K., 1983. A Role Theoretic Analysis of Scenic Quality. In Robert D. Rowe and Lauraine G. Chestnut (Eds.) Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Boulder, Co.: Westview Press, 117-126.

Driver, B. L., 1976. Quantification of outdoor recreationists' preferences. In Betty Van der Smissen and J. Myers (eds.). Research: Camping and Environmental Education. Penn. State University, HPER No. 11.

Driver, B. L., Rosenthal, D., and Johnson, L., 1979. Air pollution, values, and environmental behavior. In D. Fox, Loomis, R. J. and Greene, T. C. (eds.) Proceedings of the Workshop on Visibility Values. U.S. Forest Service Technical Report WO-18, Fort Collins, CO., 100-105.

Evans, G., Jacobs, S., and Frager, N., 1982. Adaptation to air pollution. Manuscript in preparation.

Fox, D. G. What is visibility worth? USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, No Date.

Fox, D. G. and Rosenthal, D., 1981. On the use of decision analysis in determining significant visibility impairment. Atmospheric Environment, 15(12), 2503-2510.

Greene, T., Breeding, M. and Grant, J., in press. Affects of framing and instructional set upon judgments of visual air quality. Journal of Environmental Psychology.

Heider, F., 1958. The psychology of interpersonal relations. New York: Wiley, 1958.

Heider, F., 1944. Social perception and phenomenal causality. Psychological Review, 51, 358-374.

Henderson, H., 1978. Creating Alternative Futures. New York: Berkley Windover.

Henry, R. C., 1979. Psychophysics and visibility values. In Douglas G. Fox, Ross J. Loomis and Thomas C. Greene (eds.) Proceedings of the Workshop in Visibility Values. USDA Forest Service General Technical Report WO-18, Jan-Feb., 1979, 81-84.

Henry, R. C., 1983. Psychophysics, Visibility and Perceived Atmospheric Transparency. In Robert D. Rowe and Lauraine G. Chestnut (Eds.) Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Boulder, CO.: Westview Press, 64-74.

Latimer, D. A., Hugo, H., Hern, D. H. and Daniel, T. C., 1983. Effects of visual range on the beauty of national parks and wilderness area vistas. In Robert D. Rowe and Lauraine G. Chestnut (eds.) Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Boulder, CO: Westview Press, 41-50.

Loomis, R. J. and Greene, T. C., 1979. Air pollution, values, and environmental behavior. In Douglas G. Fox, Ross J. Loomis and Thomas C. Greene (eds.) Proceedings of the Workshop in Visibility Values. USDA Forest Service General Technical Report WO-18. Jan-Feb, 1979, 106-115.

Loomis, R. J. and Greene, T. C., 1983. Two examples of psychological assessment of visual values. In Robert D. Rowe and Lauraine G. Chestnut (eds.) Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Boulder Co.: Westview Press, 173-181.

Malm, W. C., MacFarland, K. Kelley, Molenar, J., and Daniel, T. C., 1983. Human Perception of Visual Air Quality (Layered Haze). In Robert D. Rowe and Lauraine G. Chestnut (eds.) Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Boulder, CO.: Westview Press, 27-40.

McConnell, K. E., 1983. Existence and Bequest Value. In Robert D. Rowe and Lauraine G. Chestnut (eds.) Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Boulder, CO: Westview Press, 254-264.

Nelson, S. D. and Caplan, N., 1983. Social Problem Solving and Social Change. In Daniel Perlman and P. Chris Cozby, Social Psychology. New York: Holt, Rinehart and Winston. Chapter 19.

Rae, D. A., 1983. The value to visitors of improving visibility at Mesa Verde and Great Smokey National Parks. In Robert D. Rowe and Lauraine G. Chestnut (eds.) Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Boulder, CO: Westview Press, 217-234.

Randall, A., and Stoll, J. R., 1983. Existence value in a total valuation framework. In Robert D. Rowe and Lauraine G. Chestnut (eds.) Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Boulder, CO: Westview Press, 265-274.

Stewart, T. R., 1983. Visual air quality values: Public input and informed choice. In Robert D. Rowe and Lauraine G. Chestnut (eds.) Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas. Boulder, CO: Westview Press, 127-142.

Wicker, A. W., 1979. An Introduction to Ecological Psychology. Monterey: Brooks-Cole.